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KANSAS CITY, MISSOURI

DECEMBER 7, 8, 9, 1949

HEADQUARTERS:

HOTEL PHILLIPS

Joint Meeting

with

International Crop Improvement Association

Thursday, December 8 in the Hotel President

Titles of papers for presentation at the meeting should reach Dr. Ora Smith, Cornell University, Ithaca, New York, by November 10, 1949. Abstracts of papers will be due November 15, 1949.

Room rates are as follows: $3.00 to $5.00 single; $5.00 to $8.00 double; $7.00 to $8.00 twins; $12.00 to $18.00 suites. The Hotel Phillips is located at 12th and Baltimore, 1½ blocks from the Hotel President. Make reservations early.

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CRACKING OF TRIUMPH POTATOES[1]

F. V. PUMPHREY AND LIONEL HARRIS[2]
Nebraska Agricultural Experiment Station,
Scottsbluff Substation, Mitchell, Nebr.

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INTRODUCTION

Potato growers in western Nebraska are fully aware of the ease with which immature Triumph potatoes crack during harvest. Great care in handling these potatoes is necessary to avoid considerable tuber cracking. Records of certification inspectors show that an average of 15 to 25 per cent of potatoes harvested annually in western Nebraska are damaged by cracking to an extent that they fall below U. S. No .1 or even No. 2 grade. Actually, during most years cracking damage among individual growers ranges from 5 to 75 per cent of the tubers harvested. The nature and cause of tuber cracking in Triumph pota-

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[2]Assistant Agronomist U.S.D.A., and Station Superintendent respectively. The authors acknowledge assistance of Dr. H. O. Werner, Horticulturist, Nebr. Agr. Exp. Sta., in the planning and general conduct of this experiment.

toes has been studied by Werner and Werner and Dutt (1, 2)[3]. These workers concluded that tubers crack at harvest primarily because of their high turgidity, and that they are most susceptible to cracking under conditions which tend to increase the water readily available to the tuber. An increase in soil moisture and a reduction in loss of water by transpiration which might be caused by frost, low temperature, or high humidity increases the water available to the tubers and makes them much more susceptible to cracking.

Extreme care in handling tubers during harvest has always proved advantageous in preventing or reducing the amount and severity of tuber cracking. However, under certain conditions the most careful methods of handling have not proved sufficient to prevent more or less serious cracking of tubers at harvest time. Werner and Dutt found that cutting roots a short time prior to harvesting Triumph potatoes was effective in reducing the amount of tuber cracking during harvest. Although many potato growers in western Nebraska have used the root cutting method successfully and to good advantage in reducing tuber cracking at harvest, many other growers, particularly in the irrigated section, have not adopted the method consistently. This may be due to a number of factors: (a) absence of a standard root cutting machine which will perform satisfactorily under varied conditions, (b) failure of grower to properly adjust and operate machines now available, (c) difficulties encountered in cutting potato roots where the crop has been grown after alfalfa which was plowed under as a green manure, and (d) difficulties encountered in digging potatoes on certain sandy soils after the root cutter has been used. Many growers have recently become interested in various methods of vine destruction in their efforts to do a better job of harvesting the delicate Triumph tubers. Vines have been destroyed with varied success by chemical sprays, land rollers and mowing machines. During the fall of 1948 considerable interest was aroused by the advent of the roto-beater. This machine chops the vines into small bits by means of paddles of hard rubber or iron attached to a large spool which operates at high speed. The great advantage of such complete destruction of vines for expediting the digging and hand picking of potatoes is self evident. However, in view of earlier research and experience which demonstrated that sudden destruction of vines failed to reduce cracking immediately, it appeared advisable to obtain further information about tuber cracking following the use of different methods of vine destruction as compared with root cutting.

[3]Figures in parenthesis refer to literature cited page 361.

Experimental Procedure

During the fall of 1948 an experiment was conducted at the Scotts Bluff Field Station to determine the influence of three preharvest treatments on the tendency of Triumph potatoes to crack during harvest. The three treatments comprised: (a) destruction of the vines by chemical spray, (b) destruction of vines by the roto-beater, and (c) severing potato roots with a root cutter. The chemical used for the vine spray treatment was a standard brand of the kind used in areas where this method of vine destruction is more common. The sprayed vines wilted within one day and died within four days. The three treatments, replicated twice, were applied on the 29th of September and again on the 3rd of October. Each plot consisted of two rows approximately 400 feet long.

The field of Triumph potatoes selected for this test showed a heavy growth of vines and little tendency for the plants to mature at the time the test was started. Soil moisture was adequate for good plant growth but not excessive. Samples of potatoes dug by hand between the hours of 8:00 and 10:00 A. M. were taken at random from each plot. Warm, clear weather prevailed until the 5th of October. Maximum daily temperatures varied between 62 and 80 degrees Fahrenheit and minimum temperatures between 42 and 50 degrees Fahrenheit. A killing frost occurred on the night of the 6th of October.

In order to determine how soon these treatments became effective or how long they remained effective, samples were dug by hand at two-day intervals until frost. Therefore, three samples were taken during the period from the 29th of September to the 5th of October. Fifty potatoes were dug from each treatment at each sampling date. Immediately after digging, each potato was dropped from a height of ten inches onto a cement brick. This uniform exposure to mechanical shock represented more severe treatment than potatoes encounter in ordinary harvest operations, but not necessarily more severe than some tubers encounter under careless methods of digging, picking and hauling. Immediately after this cracking test each sample was sacked separately and stored until it was graded at a later date. The samples were handled with extreme care in order to avoid further damage to the tubers. The potatoes were sorted into three grades—U. S. No. 1, U. S. No. 2, and culls—depending upon the amount and severity of cracking damage (other grade defects such as scab, knobs, etc. were ignored).

Results

The percentages of different grades of potatoes at various intervals after the preharvest treatments were applied are shown in table 1. The

percentage of the different grades of potatoes under the spray and roto-beater treatments was not greatly different than those from the check plot. The root cutter treatment showed considerable reduction in cull and No. 2 potatoes and an increase in No. 1 potatoes at each sampling date.

TABLE 1.—*Percentage of No. 1, No. 2 and cull potatoes at different sampling dates after vine destruction and root cutting. Potatoes graded on basis of cracks and bruises.*

Harvested		Treatment	Per Cent of Each Grade		
	Days after Treatment		No. 1	No. 2	Culls
October 1	2	No Treatment	23	44	33
		Spray	31	37	32
		Roto-beater	27	53	20
		Root cutter	67	28	5
October 3	4	No Treatment	27	48	25
		Spray	29	41	30
		Roto-beater	31	42	27
		Root cutter	62	32	6
October 5	6	No Treatment	35	46	19
		Spray	38	50	12
		Roto-beater	36	44	20
		Root cutter	54	42	4
October 5	2	No Treatment	35	46	19
		Spray	31	49	20
		Roto-beater	30	52	18
		Root cutter	58	32	10

The amount of U.S. No. 1 potatoes obtained in the check plot increased somewhat from the 29th of September to the 5th of October, probably indicating that the potatoes were naturally maturing to some extent during this period. On the 1st of October, 23 per cent of the tubers from the check plots remained in the No. 1 grade, compared with 27 per cent on the 3rd and 35 per cent on the 5th. The No. 1 potatoes from the spray treatment amounted to 31 per cent two days after treatment; 29 per cent, four days after treatment; and 38 per cent, six days after treatment. The amount of No. 1 potatoes from the roto-beater treatment amounted to 27 per cent, two days after treatment; 31 per cent, four days after treatment; and 36 per cent, six days after treatment. The greatest benefit from severing the roots of potatoes with the root cutter occurred within two days after this treatment was applied. At this date 67 per cent of the sample tubers, after being

dropped on a concrete brick, were still classed in the No. 1 grade, compared with 62 per cent four days after treatment, and 54 per cent six days after treatment.

The results of the application of treatments applied the 3rd of October and sampled two days later are somewhat different than results of application of treatments on the 29th of September. This may be due to the fact that much cooler and partly cloudy weather prevailed at this time. The results of sampling on the 5th of October from treatments made two days earlier show 35 per cent No. 1 potatoes in the check plot; 31 per cent, from the sprayed plots; 30 per cent, from the roto-beater plots; and 58 per cent, from the plots treated with the root cutter.

The potatoes from all plots were harvested according to common practice on the 9th of October. Samples of approximately 225 pounds from each plot were obtained and graded on the basis of mechanical injury. The results of preharvest practices on the grade of potatoes harvested according to common practice are shown in table 2. From treatments applied on the 29th of September and harvested according to common practice on the 9th of October, 61 per cent of the potatoes from the check plot were classed in the U.S. No. 1 grade compared with 67, 76, and 86 per cent from the spray, roto-beater, and root cutter treatments, respectively. From treatments applied the 3rd of October, 61 per cent of the tubers from the check plot were classed in the No. 1 grade compared with 62, 59, and 80 per cent from the spray, roto-beater, and root cutter treatments, respectively.

TABLE 2.—*Influence of preharvest practices on grade of Triumph potatoes commercially harvested on October 9. Potatoes graded on basis of cracks and bruises.*

Treatments	Per Cent of Each Grade		
	No. 1	No. 2	Culls
	Treatment Applied September 29		
No Treatment	61	27	12
Spray	67	22	11
Roto-beater	76	14	10
Root Cutter	86	10	4
	Treatment Applied October 3		
No Treatment	61	27	12
Spray	62	26	12
Roto-beater	59	27	14
Root Cutter	80	14	6

Summary and Discussion

An experiment was conducted at the Scotts Bluff Field Station during the fall of 1948 to determine the influence of preharvest treatments upon the tendency of Triumph potatoes to crack during harvest. The treatments used included: (a) destruction of vines by chemical spray, (b) destruction of vines mechanically with a roto-beater, and (c) severing potato roots with a root cutter. Each of these treatments was applied at two different dates—the 29th of September and the 3rd of October. The treatments were compared in each instance with a check plot which received no treatment.

The destruction of vines by chemical spray or mechanically with a roto-beater failed to reduce tuber cracking in Triumph potatoes during the eleven-day period of this test from the 29th of September to the 9th of October. The results indicated that during cool weather destruction of vines by either method might increase tuber cracking as compared with no treatment. Severing potato roots with a root cutter proved much more valuable in reducing tuber cracking than vine destruction with chemical spray or with the roto-beater. The greatest benefit from the use of the root cutter occurred within two days after the roots were cut. No benefits from the standpoint of the reduction of tuber cracking occurred even eleven days after vine destruction by chemical spray or mechanically with the roto-beater, whereas the root cutter treatment still showed considerable benefit after this period of time. From a practical standpoint, potato roots should be severed with a root cutter only a day or two ahead of digging.

Although the roto-beater failed to reduce the tendency of Triumph potatoes to crack during harvest in this test, it did facilitate greatly the actual digging and hand picking of potatoes. This appears to be the main advantage of vine destruction with a roto-beater. The use of the roto-beater for vine destruction early enough to allow for loss of turgidity and for ripening of the tubers before digging might not prove practical in western Nebraska because early destruction of vines could result in reduced yields; and on the other hand, late destruction of vines with an interval of time ahead of digging might place the tubers in serious danger of freezing. The elimination of vines at a late date might represent the removal of some protection from field frost. The destruction of vines directly ahead of digging might prove to be the most practical use for the roto-beater machine in western Nebraska. In view of the rather large and immediate benefits of severing roots with a root cutter in the reduction of tuber cracking, it is apparent that greater effort should be expended to perfect a root cutter machine

which will operate satisfactorily under all conditions encountered in digging potatoes in western Nebraska.

Literature Cited

1. Werner, H. O. 1941. The cause and prevention of mechanical injury to potatoes. Nebr. Agr. Exp. Sta. Bull. 260.
2. Dutt, J. O. 1941. Reduction of cracking of late crop potatoes at harvest time by root or vine killing. Amer. Potato Jour. 18. Pp. 174-178.

RECENT FERTILIZER AND CULTURAL INVESTIGATIONS WITH THE POTATO*

Ora Smith

Cornell University, Ithaca, N. Y.

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Most of the literature reviewed in this paper appeared in 1948. However, some publications of earlier years which have not been reviewed in this Journal are included.

General Culture

Houghland and Parker (21) in Virginia obtained the largest financial returns beyond estimated cost of seed and fertilizer from seed spaced 15 or 18 inches in rows 36 inches apart and from 2,000 pounds per acre of 5-10-5 fertilizer. Smith (55) presented a discussion of the following topics: improved potato varieties, methods of handling seed potatoes, fertilizing, chemical weed control, killing potato vines, harvesting machinery, insect and disease control, use of chemicals to retard sprout growth in storage and improved methods of marketing potatoes. Pratt (43) found that 15 of 17 blight resistant varieties yielded higher than Katahdin, Green Mountain or Rural. Ashworth and Essex yielded the highest weight of scabby tubers. The Essex, Chenango, Virgil, Snowdrift and Placid set the largest number of tubers. Chenango, Empire and Snowdrift were as good or better in appearance than Katahdin. Virgil, Placid, Fillmore and Essex had highest per cent of rough and unattractive tubers. Hardenburg (18) found that yields may be reduced from 10 to more than 50 per cent by vine injury caused by sprayer and tractor wheels. He found no relation of wheel injury to season of maturity or habit of growth of the varieties used.

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*Paper No. 318. Department of Vegetable Crops, Cornell University.

Fertilizing Potatoes

Terman and Hawkins (60) state that considerably more P and K_2O fertilizer is commonly used in Aroostook County, Maine, for potatoes than is necessary for efficient production. Fertilizer applications range as high as 160 lbs. N, 320 lbs. P_2O_5, and 320 lbs. K_2O per acre. Tests show that 160 to 200 lbs. of P_2O_5 and K_2O are adequate on practically all the soils. A 2-3-3 ratio appears to be a more satisfactory ratio on most soils than any now mixed for the potato farmer. Applications of 120 lbs. N and 180 lbs. P_2O_5 and K_2O per acre are indicated. Peech (41) reported a marked accumulation of readily soluble P in all soils studied from the important potato-producing areas. This accumulation varied in different soils. In general, the amount of readily soluble P increased with the increasing degree of saturation of the soil with phosphate. In the light-textured soils containing large amounts of readily soluble P in the surface layer, there has been appreciable downward movement of P into the subsoil. Despite the low cation-exchange capacity and the low pH value, the exchangeable K content of many of these soils has been greatly increased by fertilization. This accumulation is relatively small as compared with the total amount of K applied over a period of years. The majority of the soils had pH values below 5. The amounts of exchangeable calcium and magnesium were very low. In some areas the soils were extremely deficient in magnesium. The organic matter content was low and was quite variable in many of the soils even within the same series. In some of the areas the organic matter content of the soils has been increased, whereas in other areas it has been decreased by cultivation.

The effect of manure and mineral fertilizers on the soil and on potatoes was investigated by Opitz (38). K was added as 40 per cent potash salts and P as superphosphate. Leuna saltpeter was the source of N. The effect of CaO additions was also investigated. N-P-K fertilization increased the soil pH from 4.2 to 5.2. The best soil reaction (pH 6.1) was obtained with N-P-Ca fertilization. The effect of manure depended only on its nutrient content; the organic material had no effect because of rapid decomposition. Complete fertilization increased potato yields about 3-fold. $NaNO_3$, $CaNH_4$ nitrate, $(NH_4)_2SO_4$ and $CaCN_2$ were compared as to their effect on the yields of potatoes. $CaCN_2$ was most beneficial. The addition of 30 kgs. per hectare of N was sufficient for potatoes. The average yield per kg. N was 80 kg. potatoes. Four K salts, kainite, 40 per cent potash salts, K_2SO_4, and KMg sulfate, were compared. The sulfates gave highest yields of potatoes. The Mg-containing sulfate often proved superior

to K_2SO_4, indicating a Mg deficiency in the soil. Lyons, Russel and Rhoades (30) obtained increased yields of potatoes when superphosphate was applied to calcareous soils. After a period of cropping where no manure or small quantities were used, superphosphate was also beneficial on non-calcareous soils. On calcareous soils it proved most beneficial when applied at 100 to 150 lbs. per acre; on noncalcareous soils, from 70 to 100 lbs. per acre. Comparatively few tests showed that western Nebraska soils were not deficient in K. Additions of Mg, Mn, Fe, Cu, Zn, or B were not necessary.

Analyses of virgin and cultivated Northern Wisconsin soils show that when potatoes are grown on these soils from 10 to 30 years the available phosphorus and soluble manganese content and acidity are increased whereas the available potassium, calcium and magnesium contents are seriously depleted, Berger (6).

Houghland (22) discussed the danger of considering gross rather than net returns from fertilizers.

Highest yields with respect to amount as well as to starch content were obtained by Schonfeld (47) on acid, unlimed soils; next were yields on lime-treated acid soils, and last on calcareous soils. Berger (6) found in Wisconsin that an application of 800 lbs. of 3-12-12 in the row increased the yield as compared with unfertilized by about 60 bushels per acre. More than this in the row was not beneficial but an additional broadcast application of 1200 lbs. 6-6-18 nevertheless gave a further increase of 80 bushels.

Nitrogen

Vlasova (64) found that physiologically alkaline forms of N consistently gave increased yields of potatoes over a period of 6 years. Physiologically acid sources of N consistently gave lower yields after the fourth and fifth years. The decrease in yield by the acid-giving salts may be partially overcome by liming. Tandon (59) found respiration rate of potato tubers, as measured by amount of CO_2 evolved per unit weight, increased with increasing fertilization during growth. The plots were given 0, 40, and 80 lbs. of N as $(NH_4)_2SO_4$ per acre, and the higher respiration rate of potatoes from the fertilized plots was observed whether determined at 64, 78, 92, or 103 days after planting. The extent of losses of potatoes during storage appeared to be correlated with the higher respiration rate.

Phosphorus

Van der Paauw (40) found that the yield and dry matter of potatoes increased with the amount of phosphate applied to a soil low

in phosphate. Six hundred kilograms P_2O_5 per hectare gave better growth than from any lesser quantity. Nitrogen was absorbed early under all concentrations of phosphorus, phosphorus absorption resulted only after a heavy P_2O_5 application. Nitrogen absorption stopped with the beginning of dying of the tops. The phosphate deficient plants remained green longer, possibly because their water output was less. The distribution of dry matter, water, nitrogen and P_2O_5 in the plants at various times was rather constant but marked changes occurred with the formation of tubers and the removal of dry matter from the leaves to the tubers which preceded the decay. The rate of total assimilation varied from 0.2 g. per gram leaf with abundant phosphorus fertilization to 0.13 in phosphorus-deficient plants.

A record is presented by Shcherba (48) of field experiments with different carriers of P, such as Thomas slag, ground rock phosphate, ordinary superphosphate, precipitated phosphate, and liquid phosphoric acid, on a series of crops. The raw rock phosphates and slags decreased the acidity of the soil. On the degraded (leached) chernozem, potatoes showed a preference for the soluble forms of P. No positive effect was noted from the gypsum of the acid phosphate on clover and potatoes.

Houghland (20) found that when the nutrient solution contained 1.5 ppm PO_4, the plants of Green Mountain variety made excellent growth, and in 0.5 ppm the plant height was slightly reduced and the dry matter and PO_4 in the plants were decidedly less. When the concentration of the solution was further reduced to 0.1 ppm, the plants were much smaller, symptoms of PO_4 deficiency developed, and there was a pronounced reduction in dry matter and PO_4. It is suggested that the 1.5 ppm concentration corresponds to the critical percentage of Macy, the 0.5 concentration his "poverty adjustment" and the 0.1 concentration his "minimum percentage." It appeared that mature leaves selected from the middle of potato plants could be used to determine the general level of PO_4 uptake. In general, the amount of PO_4 absorbed increased as the solution concentration increased, but the percentage of PO_4 recovered by the plants was greater in the more dilute solutions.

Jones and Green (23) obtained increased yields of potatoes from the addition of liquid phosphoric acid to the irrigation water.

Dean *et al* (12) found an inverse relationship between the phosphorus fertility status of soils and the percentage of phosphorus in the crop that was derived from the fertilizer applied at planting time. In pot tests with potatoes less than 2 per cent of the phosphorus in

the plants 20 days after emergence was derived from the fertilizer. At 80 days more than 50 per cent of the phosphorus in the plants grown on soil having a fertility level of 300 lbs. per acre of available P_2O_5 was derived from the fertilizer. On soil having a fertility level of 500 lbs. per acre P_2O_5, 30 to 50 per cent of the phosphorus in plants was derived from the fertilizer. There was a tendency for the plants grown on limed soils to have a higher percentage of phosphorus derived from the fertilizer than corresponding plants grown on unlimed soils. Contact placement as compared with band placement, tended to increase the per cent of phosphorus in plants which was derived from the fertilizer. The application to calcareous soil of 150 rather than 50 lbs. P_2O_5 in the form of superphosphate tended to increase the per cent of phosphorus in the rye grass derived from the fertilizer. Factors which affected growth did not necessarily alter the relative amounts of native and fertilizer phosphorus utilized by plants. Nelson *et al* (35) found that potatoes absorb a relatively high proportion of fertilizer phosphorus compared with native phosphorus throughout the growing period. The percentage of fertilizer phosphorus absorbed increased with the rate of application and decreased as the amount of native soil phosphorus increased. Potatoes absorbed approximately 10 per cent of the applied phosphorus on the soils highest in native soil phosphorus. Contact placement of fertilizer with the seedpieces decreased the percentage of phosphorus absorbed from the fertilizer.

Nelson and Hawkins (34) made a study to show the relationship between the amounts of readily soluble P and exchangeable K in the soil and the response of Irish potatoes to applications of these nutrients. Two years yield data from North Carolina showed that applied P gave significant increases in yield at all six test locations. Significant increases were obtained on 8 of the 9 experiments in Maine. The degree of yield response to applications of P_2O_5 was related to the amount of readily soluble P in the soil. Yield increases from the first 80 lbs. of P_2O_5 applied decreased as the amount of readily soluble P in the soil increased. The P content of the leaves in the North Carolina experiments was related to the amount of readily soluble P in the soil and to the amount of P applied. In the Maine experiments the P content of the rachises samples during the early-bud stage was related to the amount of P applied. P was particularly important in influencing the number of tubers per hill on soils low in readily soluble P. Significant increases in yield from applied K_2O were obtained in all experiments in North Carolina and in 5 out of 8 experiments in Maine. The weight of potatoes resulting from the first 60 lbs. of K_2O tended

to decrease as the amount of exchangeable K_2O in the soil increased. In the North Carolina experiments the K_2O content of the leaves was related to the amount of K_2O in the soil and to applied K_2O up to 120 lbs. of K_2O per acre. The amount of K extracted from the rachises of the potato plants in the Maine experiments was related to the exchangeable K_2O content of the soil and to the amount of K_2O applied.

Van der Paauw (39) found that the phosphate soluble in 1 per cent citric acid was satisfactorily correlated with the increase in yield obtained by fertilizing with phosphate. A P-citrate number of 40 represents a good phosphate supply for potatoes. The lime content of the soil influences the fertilizing effect of the phosphate; optimal results are obtained with 3-6 per cent lime. The clay content does not seem to change the fertilizing action. Superphosphate may possibly be somewhat more effective than dicalcium phosphate, but it injures the crop occasionally. No significant difference was seen if phosphate was applied before plowing in the fall or after plowing in spring. There was also a satisfactory correlation between the K-HCl number (K soluble in 0.1 N HCl) and the yield obtained by fertilizing with K salts if the clay and to a lesser extent the lime content of the soil was taken into consideration. A difference of 10 per cent corresponds to a difference of 2 to 4 units of the K-HCl number. Soils with about 3 per cent lime gave best effects.

Potassium

Brodskaya (10) showed that K_2SO_4 caused an increase of starch in the potato, compared with KCl. Sylvinite proved to be inferior to KCl for potatoes when physiologically acid salts of P and K have been used. With lime and organic matter, sylvinite proved to be superior to KCl. Fractional applications of K gave definite results if 25 per cent was applied when the soil was prepared, 50 per cent when plants came up, and 25 per cent at time of blooming. For potatoes the best form of K salts was K_2SO_4 in experiments on heavy soils for a period of 4 years (Pevzner, 42). Sylvinite and carnallite have proved to be inferior to KCl for potatoes. None of the salts increased the acidity of the soil or had any effect on the composition of exchangeable bases. When the levels of exchangeable soil potassium were above 220 lbs. per acre potatoes did not respond further to additions of potash to soils in Tennessee, Winters (69). Addition of sodium to the nutrient solution increased the dry weight of potato tops and roots when the potassium content of the solution varied from none to 210 ppm, Berger (6).

Influence of Calcium and Acidity

Wallace and Hewitt (66) grew sprouted potato sets, variety Majestic, in sand with and without calcium, both pots and sand being specially treated to ensure very accurate conditions of calcium deficiency where the element was omitted from nutrient solutions. Differential N treatments, *e. g,* nitrate, NH_3, and urea, were given and some cultures also received concentrations of Mn and Al sufficiently high to produce severe toxic effects. In the cultures from which Ca was omitted the plants failed completely and the shoots did not emerge above the level of the sand. The sprouts broke down immediately behind the growing points, after which they died off. The roots appeared fairly normal and the tubers remained firm. In all cultures to which Ca was added the shoots emerged normally and it was not until a later stage of growth that signs of the other unfavorable treatments were developed. It is indicated that the hard-tuber condition which occurs in failure of plants on acid soils results from the dying back of the young shoots prior to the emergence above the soil and that this is caused by a deficiency of Ca and is not due to the presence of Mn or Al. Goedwaagen and de Willigen (17) grew seven varieties of potatoes in soil of pH 4.55, 4.9, 5.5 and 6.3. The optimal pH for root development was lower than for optimal yield, the former varies from pH 4.5 to 5.5, the latter from 4.9 to 6.3. Berger (6) states that when soils are below pH 5.0 finely ground dolomitic limestone should be applied to add available calcium and magnesium to the soil and to reduce the amounts of soluble manganese present in some Wisconsin soils. Additional soluble magnesium in the fertilizer often is advisable.

Trace Elements

Brodskaya (9) found that on light podzolic soils the non-ballasted fertilizers, free of elements other than N, P, K in the fertilizer salts, proved to give higher yields of potatoes as well as higher yields of starch. Dostal (13) found that out of 12 minor elements in Hoagland A-Z solution, only B and Zn considerably increased the growth of the potato seedlings in solution cultures. Zn stimulated more the growth of the stems and B that of the roots and tubers. Mn and Cu, did not affect appreciably the growth of these seedlings. Katalymov (27) found an increase in boron uptake of potatoes along with an increase in yield, boron uptake varying from 53 to 106 grams per hectare.

Berger and Gerloff (7) described symptoms of stem streak necrosis which occurs commonly in potatoes grown on soils more acid than pH 5.0. Fertilizers which lowered the pH of the soil increased the

severity of the necrosis; it was prevented by the addition of lime. Neither acidity, soluble aluminum nor a deficiency of calcium, magnesium or boron was the cause of the necrosis. As little as 2 ppm soluble manganese in nutrient solutions caused severe necrosis identical to that observed in potatoes in the field. More than 2 ppm manganese was found in displaced soil solutions of soils on which stem streak necrosis had been prevalent in the field while only trace amounts were found in the solutions from the same soils after they had been limed in the field. The application of lime to maintain a soil reaction of pH 5.0 to 5.3 was the most practical means of preventing this necrosis.

Plant Tissue Testing

Nicholas (36) states that tissue test data when related to the seasonal cycle may be used to anticipate the development of mineral deficiencies and toxicities which may only become apparent later in the season. The method may be used to replace total chemical analysis for the rapid diagnosis of mineral disorders and may be used in a complementary role to other field methods. It has been found particularly useful as an adjunct to the visual method.

Atkinson *et al* (3) found that analysis of sodium acetate extracts of fresh potato stems showed that concentration of nitrates and potassium usually decreased as the season advanced. The concentration of phosphates tended to be at lower levels late in the growth period. The amounts of nitrates and potassium found in the plant tissues were usually increased when these nutrients were supplied in the fertilizer. The concentration of plant phosphates was not similarly affected by the addition of phosphorus to the soil. Frequently when the nitrate concentration was increased that of phosphate decreased and when the amount of nitrates showed a decrease that of phosphates showed an increase. Plants grown on the same fertilizer treatment on different areas could have approximately the same concentration of nitrates, phosphates and potassium in their tissues, but the yield from one area could be double that from the other.

Nyland (37) found that soil applications of nitrogen fertilizer at the rate of 80 or 160 pounds to the acre approximately doubled the nitrogen content of potato petioles and doubled the yields of tubers. The concentrations of soluble phosphorus and K_2O were inversely correlated with the soluble nitrogen content of the petioles. Applications of phosphate and potash fertilizers had no effect on yields of tubers nor on soluble nitrogen content of petioles. Maximum yields were obtained when the soluble nitrogen content of the petioles at time of first visible

flower buds was 600 to 700 ppm, the soluble phosphorus centent was 300 to 400 ppm. and the soluble K_2O was 4200 to 6200 ppm.

The application of fertilizers is reflected in the lower petioles of the plant by the methods of tissue analyses employed by Hill and Cannon (19). Tissue analyses indicated that if plants grown on muck soil contain less than 3,500 to 4,000 ppm. of potassium, yield will be depressed. From the lowest level of phosphorus up to 70 ppm. there was no relationship with yield but with levels above 70 ppm. there was a negative relationship. The negative relationship held only if the potassium level was below 3,000 ppm. With nitrogen up to 200 ppm. there is probably a positive relationship with yield, whereas with nitrogen from 200 to 1,000 ppm. there is a negative relationship with yield. There is a significant negative relationship between the combined nitrogen and phosphorus unit on potassium levels and the effects of the higher categories of nitrogen or phosphorus levels on yield are laregly conditioned by the potassium level.. A negative relationship exists between levels of potassium and magnesium and between potassium and calcium. Low potassium in the tissue is associated with an accumulation of magnesium and calcium.

Lignin as a Fertilizer

Potatoes grown in pots with layers of lignin between soil layers showed some increase in growth compared with soil alone, Dunn and Seiberlick (14). Aries (2) states that the use of lignin from dilute acid hydrolysis increased the starch content of potatoes by 85 per cent. A partially hydrolyzed wood containing cellulosic materials, as well as sawdust, gave less satisfactory results.

Application of Hormones

A study was made by Trnka, Frantek and Praskac (62) of the effect of the principal nutrients of commercial fertilizers when used with simultaneous hormonization with natural auxins in the liquid manure from pregnant cows and with synthetic heteroauxins of varying concentrations. The effectiveness of the nutritive substances was verified for potatoes. Their effect on the biochemical processes and the relative and absolute yield could not be duplicated by the substitution of other active principles of vegetable origin, especially the hormones. When used in connection with other biological elements and active principles, the liquid manure from pregnant cows did produce an increase in production. Synthetic heteroauxins in concentrations of 0.00125-0.005 per cent likewise produced an increase in absolute yield.

The hormonization of potatoes must be done before sprouting occurs, since otherwise the sprouts are burned. The increase in plant mass was due to the stimulating effect on the vegetable organs. The hormonization of potatoes still cannot be recommended as a universal means of increasing agricultural production. Malcher and Medal (32) state that treatment of potato tuber cuttings with heteroauxin increased the yield of Erstling 13.7 per cent, Ackersegen 22 per cent and Kurba 27 per cent. Hormone treatment increased nitrogen, starch and ash content of tubers. Other experiments were made with 8 tablets of Euradin in 200 liters of water applied to 25 kilograms of seed potatoes and with Euradin plus alpha naphthyloctylacetic acid.

Weed Control with Chemicals

Bradley and Ellis (8) reported that applications of 0.875 lb. per acre of 2,4-D in the form of 70 per cent sodium salt in the regular potato spray mixture resulted in control of weeds and no significant decrease in yields of Katahdin. Warren and Hernandez (67) found that 2,4-D mixed in the soil or sprayed on the soil surface at rates of 2 and 4 pounds to the acre resulted in fair control of weeds and no significant reduction in yield of potatoes on muck soil as compared with plots where weeds were allowed to grow. A direct spray of 0.8 pound 2,4-D when potatoes were about 8 inches high resulted in good weed control. Alban and Keirns (1) found that repeated applications of 0.13 and 0.33 lb. butyl ester of 2,4-D reduced the number and size of weeds in Katahdin potatoes but serious injury was caused to the crop. Potatoes grew satisfactorily when 1.32 lbs. butyl ester of 2,4-D was applied as a preemergence treatment. Thompson and Shuel (61) obtained excellent control of annual broadleaved weeds in potatoes from 2,4-D applications at the rate of 1.2 lbs. to the acre. Neither yield nor quality of Katahdin potatoes was depressed in 1946 or 1947. A varietal and seasonal difference in reaction to 2,4-D was found, Cobbler being more sensitive than Katahdin.

Smith, Meadows and Marshall (56) presented results of three year's research on controlling weeds in potatoes with chemicals. The best control of weeds was obtained by application of materials from two to three weeks after planting but before potatoes emerge. Postemergence application of 2,4-D at time of last hilling at the rate of one pound to the acre controlled weeds and resulted in no injury to the potatoes. Excellent weed control and high yields of potatoes were obtained from applications of Dow Contact Weedkiller, Sinox General plus diesel oil, pentachlorophenol and oil, sodium pentachlorophenate,

Esso HAN 132 and several other oils. Excellent control of weeds but some decrease in yield was obtained from sodium and ammonium trichloroacetate. 2,4-D resulted in decreases in yield in some areas in 1948.

Smith, Marshall and Meadows (57) found that potato growing methods could be changed considerably from the conventional methods when weeds are controlled with chemicals instead of by cultivation. By planting potatoes in rows closely spaced and by very high applications of fertilizer and a high rainfall yields approaching 1,000 bushels to the acre were obtained. The method appears to be especially suited to the production of potatoes for seed purposes.

Killing Potato Vines

Callbeck (11) found that tubers from untreated cut vines showed a greater incidence of stem end discoloration than tubers from untreated plants or from plants destroyed by slow acting herbicides. Tuber vascular discoloration appears to be correlated with rapidity of kill of the tops. The amount and intensity of discoloration of tubers from plants killed at different stages of development with dinitro compounds increased quite regularly with the age of the plants. There were no differences in culinary quality of cooked tubers from the various treatments. McGoldrick and Smith (33) found that those killing agents which destroyed top growth most efficiently and rapidly reduced specific gravity of the tubers compared to lesser destruction and those unkilled. Discoloration of the vascular region of tubers was decidedly increased by killing injury to top growth. Neither killing agents nor application dates appeared to have a significant effect on the value of tubers as a source of seed the following season. Kunkel, Edmundson and Binkley (28) found that killing vines resulted in lower specific gravity of the tubers and that tuber color with Bliss Triumph and Red McClure faded with maturity. Dowspray 66 and Sinox are considered worthy in Colorado. No significant increase in stem-end discoloration resulted from their use in 1947.

Retardation of Sprout Growth

Smith (49, 50) and Smith, Ellison, Van Geluwe and Baeza (51) have described the methods of application of methyl ester of naphthaleneacetic acid to potatoes for retardation of sprout growth in storage. Application in dust form resulted in excellent control of sprout growth and usually is more convenient to apply than the liquid in spray form. Smith and Scudder (54) described the methods of applying methyl ester of naphthalenacetic acid in the liquid and dust forms to potatoes

in storage. In some instances decay in storage was increased by application of this material on Long Island in 1946, especially to potatoes which were immature and badly bruised at time of storage.

Smith, Baeza and Ellison (53) found potatoes resistant to spray applications of 10 ppm. 2,4-D and 10,000 ppm. methyl ester naphthaleneacetic acid when applied in August to the foliage. Injury resembling common scab occurred on many tubers from plants which had been sprayed with the latter material. Tubers from plants which had been sprayed in the field with methyl ester of naphthaleneacetic acid had less sprout growth after three months storage at 50°F. than from untreated plants. Ellison and Smith (15) obtained reductions in yield and specific gravity of tubers when plants were sprayed in July with methyl ester of naphthaleneacetic acid but no reductions from August and September applications. Sprouting of tubers in storage was best controlled by the July application but application in August also significantly reduced sprout growth. The September application had no effect. Reducing sugar content of treated tubers was lower than of untreated tubers. No significant differences were found between yields of treated and untreated tubers.

Smith, Ellison and McGoldrick (58) found that spray applications of 2, 4, 5 trichlorophenoxyacetic acid to potato plants in the field retarded subsequent sprout growth in storage. The same chemical applied to tubers in storage retarded sprout growth as efficiently as methyl ester of naphthaleneacetic acid when penetration in the tubers was assured.

Chemical Composition

Studies were made *in vivo* by Rubin and Sokolova (46) on the influence of different temperatures on the hydrolytic and synthetic activities of sucrase as well as the intensity of starch synthesis without differentiating the action of various enzymes. The optimum temperature for starch formation in the leaves varies with the age of the plant. In late July and early August it is 30°; in late August it is 40-50°. The synthesis of starch and sucrose in the leaves is not stopped even at 50° at the end of the growing season. Tests on potato tubers in September and December showed that sucrase maintained a high thermal optimum but that the optimum for starch synthesis was 37° in September and synthesis stopped at 45°. In December it stopped at 40°. The same diurnal rhythm in the carbohydrate metabolism of potato plants was observed by Kasparova and Vartanetyan (26) in the Arctic regions as in the temperate zones. The maximum activity of hydrolytic enzymes during the intense formation of the vegetative

organs was at the early morning and evening hours. Potato varieties suitable for Arctic planting are characterized by a high level of oxidative processes in the autumn period.

Prokoshev and Saval'eva (45) found that the citric acid content of potato leaves, dry weight, was 0.882-1.280, stems 0.165-0.149 and tubers 0.812-0.966 per cent. The highest concentration occurs at the top and in the center with progressive lowering in the bottom part and the cortex. No relation was found between the starch and citric acid content in the tubers. Air storage of cut stem or tuber samples for 2 to 3 days lowers the citric acid content by 12 to 25 per cent showing its utilization in respiration.

Vitamin C in Potatoes

Josefsson (24) for analysis of vitamin C used only boiled potatoes. The highest vitamin C content was obtained in unpeeled potatoes put in cold water, boiled, mashed, then mixed with 2 per cent HOP_3 to avoid further oxidation of the ascorbic acid. Small tubers were markedly superior to the large ones in vitamin C content, especially during the growing period, but the differences rapidly diminished during storage. In 1941 and 1942 the changes in vitamin C were followed during the latter part of the growing period. In these experiments the production of vitamin C seemed to be correlated with differences in temperature and light. The importance of sunshine and warmth was strongly borne out. During storage the decrease of vitamin C content was more pronounced both absolutely and relatively in varieties with high vitamin C content. Werner (68) analyzed Nebraska potatoes for their ascorbic acid content, and results showed that some varieties were superior to others. Potatoes from green vines were superior to those from mature or dead plants; and straw-mulched or dryland potatoes had higher values than nonmulched or irrigated potatoes. The amount of ascorbic acid in all potatoes decreased rapidly during storage but more rapidly at low than at high storage temperatures.

Baird and Howatt (4) studied the effect of fertilizers, vine killers, maturity and length of storage on the ascorbic acid content of nine varieties of potatoes. Ascorbic acid content was not affected by variety, fertilizers or vine killers. The apical ends of the tubers contained 20 per cent more ascorbic acid than the basal end. The highest values of ascorbic acid were obtained in August. Losses during maturation and storage were continuous and regular.

Reciprocal grafts were made by Kelly and Somers (25) between potato varieties having tubers with different ascorbic acid contents.

In addition potato rootstocks were grafted with tomato scions. Although differences in weight of tops and tubers and ascorbic acid content of leaflets resulted, the ascorbic acid content of the tubers was not affected by the nature of the scion. The ascorbic acid content of tubers was regulated by the genetic constitution of the underground portion of potato plants regardless of the genetic constitution of the aerial portion.

Vitamin C analyses are given by Baker, Parkinson and Knight (5) for 13 varieties at harvest and after storage of 5 to 6 months. These can be grouped as high, average and low in vitamin content. Values for stored potatoes are very low. One variety retained vitamin content very well in storage. No influence of various fertilizer treatments upon the vitamin content was detected in the varieties tested. Wokes and Nunn (70) found that the loss of vitamin C during winter storage was related to atmospheric moisture and the tendency to form sprouts. Changes in storage temperature between 3 and 31° was not a factor.

Prokoshev and Petrochenko (44) showed that the formation of ascorbic acid in the tissue of potato as a result of a wound is determined by an increase of cell requirements of this substance, which is related to the changes in the structure of plasmatic proteins. The changes of protein metabolism are primary and the ascorbic acid requirement is derived from them. The most important protein change is an increase of the denatured state. Infiltration of 0.02-0.2M ascorbic acid into sections of potato showed strong adsorption and almost complete cessation of biosynthesis of ascorbic acid if its infiltrated level reaches 30-43 mgs. per cent.

Potato Quality

Smith (52) showed that every lot of potatoes has a wide range in specific gravity and that specific gravity determines the degree of mealiness of potatoes. Specific gravity is directly related to dry matter content of the tubers. There are large differences between varieties in both specific gravity and mealiness. The same lot of potatoes can be separated into lots which are especially suited to boiling, frying and baking. Turnquist (63) determined the firmness of flesh of potato tubers by a pressure tester and compared the results with dry matter and specific gravity of the tubers. Differences in firmness of flesh were obtained between varieties and locations where they were grown. The association between pressure test readings and specific gravity was significant only in the case of the total correlation. Some factor in addition to dry matter influences firmness of flesh as measured by the

pressure tester. Linn, Apple and Arnold (29) obtained increases in specific gravity of tubers of ten out of eleven varieties by applications of DDT.

Stem end blackening of potatoes has been found by Wager (65) to be caused by a combination of a pigment precursor with iron. The addition of small amounts of iron salts to potato extracts greatly increased its color intensity.

Wolfenbarger, Decker and Rawlins (71) found a positive relationship between amount of benzene hexachloride applied to the soil and an increase in the number of tasters reporting off flavor in cooked potatoes which had been grown in these soils.

Machacek (31) found in a survey of Manitoba grown table stock potatoes that about 50 per cent of the samples collected consisted of mixed varieties. In 45.9 per cent of the samples the average weight of the tubers was below the optimum desired by urban consumers in certain Atlantic Coast cities. Waste from paring alone averaged 20 per cent by weight but ranged from 13.5 to 26.2 per cent. Waste from rotting, internal discoloration and related defects averaged 7.7 per cent but varied from a trace to almost 40 per cent. The monetary loss to consumers ranged from 1.6 to 103.2 cents per 100 lbs. purchased. Eskew (16) described the methods used in Europe for the utilization of potato starch factory wastes.

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DISINFECTION OF A NEW STATIONARY-TYPE SEED-POTATO CUTTER TO CONTROL THE SPREAD OF RING ROT[1]

GEORGE H. LANE [2, 3]

Colorado Agricultural Experiment Station
Fort Collins, Colo.

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INTRODUCTION

The double-edged stationary potato cutting knife (4) was introduced to provide growers of small acreages of commercial potatoes with an inexpensive seed-potato cutter which could be automatically disinfected for ring-rot control. It has been found, however, that the tip of the blade has a tendency to vibrate during rapid cutting. This paper describes an improved model of the stationary knife which overcomes this tendency of the original model.

DESCRIPTION OF THE TENSION BLADE

This potato cutter consists of a hack saw (or a length of band saw blade) which has been ground sharp on both edges and mounted vertically in a rigid frame. The disinfecting solution is supplied by a means of a rubber tube leading from a tank to a wick fitted around the upper end of the blade.

Figure 1 shows the arrangement of the blade, frame and disinfectant supply. Each end of the hack saw blade (SB) is fastened by pins into slots in the end of a 1/2 inch square steel rod (R). These slots should fit the blade snugly to eliminate twisting of the blade. The upper square rod passes through a closely fitted square hole in the guide bar (GB) and then through the top member of the frame. A nut threaded on the upper end of the rod permits the assembly to be tightened to hold the blade rigid.

A piece of lamp wick is fitted around the upper end of the blade in such a way as to form a small cloth cup (Lw), which fits the blade closely below but flares slightly above. The disinfectant is introduced into

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[2]Associate Plant Pathologist, Colorado Agricultural Experiment Station.

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this cup by way of a rubber tube (RT) from a tank above. Regulation of the rate of flow of the disinfectant may be by a valve at the base of the tank or by a screw-type pinch clamp applied to the rubber tube. It may be desirable to solder a metal cup (C) around the rod to which the base of the blade is attached to receive the waste disinfectant. It can thence be conveyed to a waste tank. The disinfectant should not be re-used.

Figure 2 illustrates the arrangement of the blade and frame in relation to a supply of seed tubers so that the operator may work with a minimum of lost motion (4).

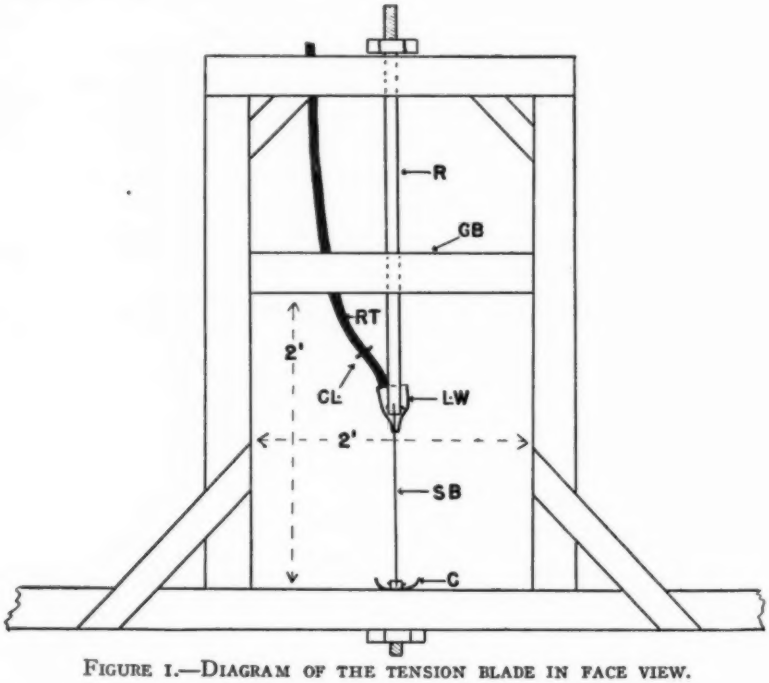

FIGURE 1.—DIAGRAM OF THE TENSION BLADE IN FACE VIEW.

Care must be exercised at all times to make sure that the disinfectant is flowing uniformly over both sides of the blade to insure satisfactory ring-rot control.

MATERIALS AND METHODS

In tests previously reported (1, 3, 4) it was observed that disinfection of the stationary double-edged knife tended to be less efficient when the cutting motion was continuously in the same direction as was necessary for rapid operation on tuber lots of 2-seed piece size. The addition

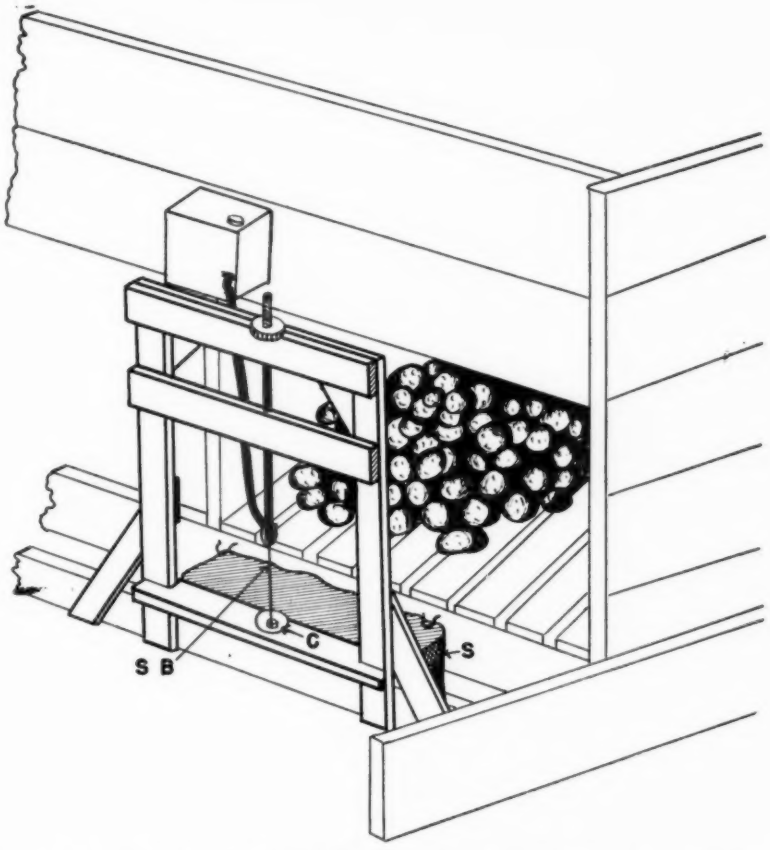

FIGURE 2.—ARRANGEMENT OF THE CUTTER AND SEED POTATO SUPPLY FOR SPEED AND CONVENIENCE OF OPERATION

of a wetting agent to the disinfectant solution was found to increase the effectiveness of ring-rot control. It might have been assumed the disinfection techniques used on the stationary double-edged knife would prove successful on the tension blade, but it seemed advisable to test this assumption in the field. Tests paralleling those made on the original double-edged knife, testing the effect of 1-way and 2-way cutting and the addition of a wetting agent to the solution, were conducted in 1947 and 1948.

In 1947 a supply of foundation Irish Cobbler seed potatoes was randomly distributed into 5 lots of approximately 55 tubers each. Fifteen to 16 tubers of each lot were then assigned at random to a control lot to be planted without cutting as a check of tuber-borne infection.

The remaining tubers of each lot were used for the cutting treatments. These were cut with the tension blade after contaminating the blade by smearing it with a ring-rot infected tuber. The blade was recontaminated after each tenth tuber cut.

Two solutions were tested for disinfection of the blade. One was 0.2 per cent mercuric chloride solution, the other was the same solution plus the wetting agent, Triton X300. The solutions were used at the rate of 2 quarts per hour. One lot of tubers was cut without disinfection to determine the effectiveness of the inoculation. Two lots of tubers were cut while using each of these disinfectant solutions on the blade. In one lot the cutting motion was always in the same direction, in the other alternate tubers passed the blade in opposite directions.

The whole tubers and cut seed pieces of each lot were then planted in 3 randomized blocks, 26 hills per plot. The tubers were cut on the 23rd of May and planted at Fort Collins, Colorado, on the 5th of June, 1947.

In 1948 a supply of foundation Red McClure seed potatoes was divided as described above to make 6 lots, one to be planted without cutting and 5 for cutting tests. Two chemicals were used as blade disinfectants, 0.2 per cent mercuric chloride and calcium hypochlorite solution containing 5000 ppm of chlorine. Contamination of the blade was as described above. One lot was cut without disinfection as in the previous year. Two lots were cut while using each chemical as the blade disinfectant, one before and one after the addition of Triton X300 to the solution. Disinfectants were used at the rate of 2 quarts per hour. Uni-directional cutting, being a more severe test of disinfection (1), was used on all lots of tubers.

Two plantings of the seed pieces were made—one of the 3 randomized blocks, 14 hills per plot, and the other of 5 randomized blocks with 22 hills per plot. The tubers were cut on the 23rd of April and planted the 1st of May, 1948, at Fort Collins, Colorado.

In each year the number of plants and the number of ring-rot infected plants per plot were determined in September. Determination of ring-rot infection was based primarily on vine symptoms. The stem-ooze test (2) and examination of tubers in the hill were resorted to in doubtful cases.

Results and Discussion

Table 1 presents the results of the two years' tests. No statistical differences were discovered in the stands. The incidence of ring-rot in the disinfected and in the whole tuber lots was so low, in contrast to

the non-disinfected lot, that no statistical treatment was necessary. It is obvious that satisfactory control of the spread of the ring-rot organism by the cutting knife was accomplished.

TABLE 1.—*Stand and number of ring-rot infected potato plants. 1947 and 1948 tests of the disinfection of the tension blade.*

Knife Disinfectant	Direction of Cut[1]	1947		1948	
		Total No. of Plants	Total No. of Ring-rot Infected Plants	Total No. of Plants	Total No. of Ring-rot Infected Plants
Uncut tubers	——	75	0	133	0
None	1-way	71	35	140	79
0.2 per cent $HgCl_2$	1-way	73	0	143	1
0.2 per cent $HgCl_2$	2-way	68	1	——	——
0.2 per cent $HgCl_2$ +Triton X300[2]	1-way	76	0	139	1
0.2 per cent $HgCl_2$ +Triton X300	2-way	69	1	——	——
5000 ppm Cl[3]	1-way	——	——	141	0
5000 ppm Cl +Triton X300	1-way	——	——	137	0

[1]1-way. All tubers pass the blade in the same direction; 2-way, alternate tubers pass the blade in opposite directions.

[2]Sodium salt of alkylated aryl polyether sulfate, 1/2 ml. per gallon.

[3]Tested with the Taylor Chlorine Slide Colorimeter.

It may be noted, however, that there appear to be no differences in the effectiveness of disinfection due to 1-way or 2-way cutting or to the presence or absence of the wetting agent in the disinfecting solution. Possibly the narrower, thinner, flatter blade of this cutter and its inherent greater stability may promote a more uniform spread of the disinfectant on the surface of the blade than is obtained on the broader. more flexible blade of the stationary double-edged knife (4). This may account for the differences in results obtained with the two cutters.

Calcium hypochlorite solution containing 5000 ppm of chlorine gave us good control of ring-rot transmission as 0.2 per cent mercuric chloride. The hypochlorite solution may be preferred by some growers, despite its odor, because of the poisonous nature of mercuric chloride.

SUMMARY

The tension blade, an improved type of the stationary double-edged potato cutting knife, is described.

Field tests of the disinfection of this cutter have shown satisfactory control of the spread of the ring-rot organism.

No significant differences in control were found between (a) 0.2 per cent mercuric chloride solution and calcium hypochlorite solution containing 5000 ppm of chloride used at the rate of 2 quarts per hour; (b) 1-way and 2-way cutting; and (c) the presence or absence of wetting agent in the disinfecting solution.

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SECTIONAL NOTES

Maine

Farmers are, in general, on the last half of their digging. Many started digging on the 19th of September but, because of frequent rains, harvested only one day that week. Digging is slow as a result of the big yields which farmers are getting. Many are averaging 200 barrels per acre with some individual fields averaging much higher. Excellent seed planted close, large applications of fertilizer, (2,000 lbs. of 8-12-16 or equivalent) a good spray program, and enough moisture are giving the largest yield in history.

A frost on the 17th of September and another heavy frost on the 30th killed the tops so that top-killing was necessary only on stock dug before the 17th. The Rotobeater has been used on some fields that were killed by frost. It makes easier and cleaner picking.

What is considered a picking record for women was established this fall when one girl picked 155 barrels of potatoes in one day.

A few certified fields are being rejected for ring rot. On the whole, however, less ring rot is being found in Certified Seed than ever. Table stock is also showing less ring rot than previous years.

Dr. Bonde's and Dr. Schultz's recent Bulletin No. 471 entitled "Control of late-blight tuber rot" was mailed to all potato growers of Aroostook, but in spite of the warning in the Bulletin some potatoes were harvested when tops were partially green as the first frost did not

thoroughly kill all fields. Some of the potatoes are showing late-blight rot. This condition is not general, but some growers are finding breakdown when these potatoes are being shipped.—VERNE C. BEVERLY.

NEBRASKA

Harvesting of the main crop in the western high plains areas of Nebraska started during the week of the 19th of September. This is somewhat earlier than the main harvest is usually begun, and was due to an unusually early frost on the night of the 12th. This frost, however, did not strike all the western area, and some fields were still partially green on the first of October.

At this time, harvest is about one-half completed, and barring weather difficulties, should be finished by the 10th of October. The general quality under both dry and irrigated conditions is better than it has been for two years. Scab, which has plagued growers and shippers alike seems to be substantially less, except in areas afflicted every season. Because of greater maturity, the tubers are being harvested with much less mechanical injury than usual. This difficulty with the Triumph variety is a common complaint, and any improvement is welcome. Because of this difficulty, many growers have been shifting to other varieties, principally Pontiac and Progress, the latter a newly named variety released to the general public a year ago.

Lighter yields were experienced over most of the territory because of the frost, and a fairly general blight epidemic, which matured many fields about the middle of September.

The yields on the dry land areas vary from 125 to 175 bushels, whereas irrigated yields range from 300 to 500 bushels per acre. Too few sales have been made to establish a market, although field run potatoes are being sold and are going into storage at prices ranging from $1.25 to $1.50 per cwt. This is without sacks or grading. At the present time, the market for graded potatoes is lower than this, considering grading and sacking costs.—MARX KOEHNKE.

NEW YORK

New York farmers are delayed in harvesting their potatoes because of wet weather and the fact that Fall rains have prolonged the growing of the vines. The crop will average about the same as last year on an acreage basis but there will be a bigger shrinkage because of over-size deformed tubers, etc. The crop has doubled during the last three weeks.

Certification is now completed and shows about 1 per cent decrease in acreage compared with last year. The volume will be further cut by

WOOD'S ROTARY CUTTER
MAKES CHAFF OF POTATO VINES

Clean cutting of potato vines and weed growth on this 35 acre field near Aquebogue, N. Y. is watched approvingly by owner, Victor Prusinowski, at right. Wood's Rotary Cutter, operated by Vic, Jr. is causing vines and weeds to literally disappear. John Burgess (left), salesman for Fanning & Housner, Riverhead, N.Y. took one look and asked "Where did it go?" Wood's Model 50 Rotary Cutter cut it for easier harvesting.

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oversized tubers in some cases and because many growers will not sort out the large size potatoes but market the whole crop as table stock.

Many favorable comments have been received on the yield and quality of new varieties like Essex, Ashworth and Ontario. Some of these varieties will make a good name for themselves in the potato picture.

Marketing agreement meetings are in the offing for this fall and winter. Growers, however, are not favorable to the compulsory and regimental features of potato legislation now in the air and their attitude is changing away from a Marketing Agreement that is not voluntary.

Markets are, at the present time, oversupplied with local potatoes of varying quality but it is anticipated that the coming of cold weather will be good for the industry as a whole in this respect.—H. J. EVANS.

NEW YORK

Field inspection was completed by the middle of September. Most of our growers are now in the process of harvesting. Preliminary lists of the acreages passed have been sent to growers and county agents. The more important varieties grown in order of importance, based on acreage, are: Katahdin, Sebago, Ontario, Essex, Chippewa, Green Mountain, and Irish Cobbler.—J. JOHN MACABEE.

NORTH DAKOTA

North Dakota Certified Seed Potato Growers have enjoyed very fine Fall harvesting weather. The crop was practically harvested by the 5th of October and is in very fine storages. The quailty of the crop was unusually good and should result in shipment of excellent certified packs. The certified acreage was 22,000 this year compared with 29,000 last year. The largest reduction was in the Cobbler variety and there were definite increases in the certified Pontiacs and Red Pontiacs. Many cars have already moved to Cuba and South Florida. Shipments will be made to this action early in October.—R. C. HASTINGS, *State Seed Commissioner.*

OREGON

The Second Field inspection of certified potatoes has just been completed. The results aren't yet available but the percentage meeting requirements seems to be slightly above normal.

Our potato growing season came to an abrupt end with a heavy frost on the 16th of September. The yield this year will be considerably below normal because of the late spring frosts. However, recovery

has been good but not sufficient to make more than about 70 per cent of a normal crop. The use of good seed was responsible for much of the recovery.—C. A. HENDERSON.

HIGH PLAINS POTATO CONFERENCE

SEPTEMBER 9-10, 1949

The Annual Meeting of the High Plains Potato Conference convened to the Alliance Hotel, in Alliance, Nebraska, the morning of the 9th of September, with 45 persons in attendance. Persons from five states were in attendance, the largest number being from Wyoming, Colorado and Nebraska. The two days were devoted to discussions on current problems in the industry and were mostly of the round table discussion type.

The problems of introducing new varieties to the trade were discussed from the standpoint of both the breeder and other interested agencies. This discussion was led by H. O. Werner. Discussions of problems involved in producing Foundation Seed Stocks were led by M. W. Felton. New certification problems were outlined by Marx Koehnke, who led a discussion of this general subject. G. H. Starr conducted the discussion on new disease problems. Roscoe C. Hill led off on insect pests and general control.

A field trip to visit the general rotations in breeding work took place at the Box Butte Experiment Station and the Scotts Bluff Experiment Station.—MARX KOEHNKE.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of American Potato Journal, published monthly at New Brunswick, New Jersey, for October 20, 1949.

State of New Jersey ss
County of Middlesex

Before me, a Notary Public in and for the state and county aforesaid, personally appear W. H. Martin, who having been duly sworn according to the law, deposes and says that he is the Editor of the American Potato Journal and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411. Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers, are:

Publisher—Potato Association of America, New Brunswick, New Jersey.
Editor—W. H. Martin, New Brunswick, New Jersey.
Business Manager—John C. Campbell, New Brunswick, New Jersey.

2. That the owner is: (If owned by a corporation its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given).

Potato Association of America, New Brunswick, New Jersey.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state). None

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholders or security holders appear upon the books of the company as a trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stocks and securities, in a capacity other than that of a *bona fide* owner and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is—(This information is required from daily publications only).

JOHN C. CAMPBELL, Business Manager.

Sworn to and subscribed before me this 10th day of October, 1949.
Anna C. Bergen, Notary Public, Middlesex County, New Jersey.
(My Commission Expires March 7, 1954).

Form 3526—Ed. 1924.

ANNOUNCEMENT

The committee which was appointed at the Pittsburgh Annual Meeting to explore the possibilities for visual education aids is requesting the membership to bring to or send to the Chairman, prior to the Kansas City meeting, their suggestions, samples and ideas for visual education material. We are requesting individuals to bring only a half dozen or so of their best photographs (slides and prints) dealing with potato insects, diseases or other subjects of interest in potato production. An opportunity for exchanging extra photographs will be provided. Samples of plastic-embedded specimens and movie films or any other usable visual education material are also solicited. It is hoped that as a result of this meeting the Committee will be able to set up a system of distribution of the material to the membership and interested persons.

COMMITTEE FOR VISUAL EDUCATION

Gordon A. Brandes, Rohm & Haas Company, 222 West Washington Square, Phila., Pa.

R. J. Haskell, U.S.D.A., Extension Service, Washington, D. C.

W. N. Keenan, Chief, Div. of Plant Protection, Department of Agriculture, Ottawa, Canada.